by Weismann's, partially liberates himself from the confusion as to individuality, and propounds the hypothesis of a *lebensferment*, which he supposes to be continually renewed in protozoa, which he thus assumes to be potentially immortal. He also fails to recognize that the true question is, not whether single protozoa die, but whether they form senescent cycles. In this error he is followed by Cholodowsky,[2] who also admits that natural death is restricted to the multicellular animals, but overlooks what would be its only possible homologue among protozoa.

Goette seems to me to have made a distinct advance beyond his predecessors, for he has attempted[3] to show that there is a death common to all organisms. Especially is his conclusion that death and reproduction are intimately connected to be noted as important; but his thought appears to me often vague and obscure, and to many of his views I can by no means assent. I have just asserted that death and reproduction are intimately connected. Now, if my theory is correct, it is evident that each cycle, before it is completely exhausted, must produce the initials of new cycles: hence the connection in time between maturity, or the approach of death, and sexual reproduction. By speculation upon the few available facts, I have reached the following hypothesis. Originally each cell of a cycle was a distinct individual; the exhaustion of the last cells of the cycle *caused* them to become sexual bodies and to conjugate; conjugation renews the power of division in the conjugated individuals, and therewith a new cycle is begun. Subsequently multicellular animals were evolved, and in these the same phenomena recur; but some of the cells have become specially organized, and thereby incapable of assuming the sexual state: hence, when the end of the cycle approaches, only a few cells become sexual, and the animal (or plant) is mature. The higher organisms become sexually active only after having grown for a considerable period, because they still preserve the primitive relation. Senility is the *auslösende reiz* of sexual reproduction. I hope to discuss the matter fully in a memoir which I am now preparing for the press.

It is evident, that, according to this hypothesis, sexual reproduction depends on the exhaustion of the cells. There are many facts known to confirm this view. Thus among men the reproductive period begins sooner when they are ill fed. Among many of the lower plants, reproduction is induced by defective nutrition. I believe that nutrition and reproduction are, indeed, opposed to one another, but by no means in the sense taken by Carpenter[1] and Spencer.[2] While I consider that the impaired nutrition causes the effort to reproduce, they believe that reproduction is opposed to nutrition, constituting a tax which withdraws just so much from the parent. Undoubtedly, in those cases where the parent, in consequence of a secondary addition to the office of genesis, has to supply food to its young, reproduction may detract from growth, but, even in such cases, only sometimes. Carpenter and Spencer's whole argument rests upon the assumption that the power of assimilation is only just equal, or about equal, to the demands of the parent. It is, however, perfectly well known that the reverse is true, and that there is in most organisms a large surplus of assimilation possible, which is used whenever the functions demand it: hence in most cases the secondary taxes of reproduction can be wholly or mainly paid without calling on the growth capital of the parent. Spencer's *a priori* argumentation I consider superficial: it has led him to an exaggerated idea of an opposition which exists in nature, but is not general. Moreover, Spencer has mistaken the cart for the horse: animals do not stop growing because they begin to reproduce, but they begin to reproduce because they stop growing; or, more strictly speaking, both events are due to one cause, — senescence.

It will be seen, upon reviewing the preceding paragraphs, that the views I advocate are opposed to all the other opinions upon the nature of death which have been noticed above. In a memoir I am now at work upon, I hope to array a large number of observations to defend the theory outlined in this essay.

C. S. MINOT.

[1] O. Bütschli (1882), Gedanken ueber leben und tod, *Zool. anzeiger*, v. 64–67.
[2] N. Cholodowsky (1882), Tod und unsterblichkeit in der thierwelt, *Zool. anzeiger*, v. 264, 265.
[3] A. Goette (1883), Ueber den ursprung des todes (Hamburg and Leipzig, 1883, 8°), p. 81.

[1] William B. Carpenter, Principles of physiology, general and comparative (3d ed., 1851), p. 592.
[2] H. Spencer, The principles of biology, vol. ii. pt. vi.

AMERICAN APPLIANCES FOR DEEP-SEA INVESTIGATION.

The wire dredge-rope.

IT was a revolution in deep-sea dredging methods, when the cumbersome hempen rope was discarded for one of wire, measuring scarcely more than one-third the same diameter, stronger, more durable, and less expensive. The introduction of wire-rope will not affect

the interests of the small-boat dredger; nor can this material be used to advantage without the aid of steam, but the active competition now existing with regard to deep-sea explorations must needs render its adoption necessary by all large expeditions.

Hemp rope was employed in all deep-sea dredgings up to the winter of 1877–78. One of the most serious objections to its use is the amount of space it occupies, especially when, as in the case of the Challenger, twenty-five thousand fathoms are carried. On the Porcupine, only three thousand fathoms of two-and-a-half and two-inch rope, weighing about fifty-five hundred pounds, were supplied; but for the convenient storage and handling of this there was required a row of twenty great iron pins, about two-and-a-half feet in length, projecting over one side of the quarter-deck from the top of the bulwark.

But a far greater objection to hemp-rope is the length of time required in making a deep-sea dredging with it, as experienced by Sir Wyville Thomson, and all other deep-sea dredgers prior to the past few years. In 1869 the Porcupine dredged in the Bay of Biscay, in a depth of 2,435 fathoms, requiring some ten hours for one haul. On the Challenger an entire day would be consumed in dredging or trawling in depths of from two thousand to twenty-five hundred fathoms.

For the utilization of steel-wire rope for deep-sea dredging, we are indebted to the fortunate suggestion of Professor Alexander Agassiz, who first recommended its use; and to Commander Sigsbee, U.S.N., who practically demonstrated its superiority over all other kinds of dredging-rope, and perfected the method of handling it. The first trials were made on the coast-survey steamer Blake, dredging in the Gulf of Mexico, in the winter of 1877–78. The size of rope then selected, and since employed by both the coast survey and fish commission, measures only $1\frac{1}{8}$ inches[1] in circumference, and has an ultimate strength of 8,750 lbs. The chief advantages of wire rope, in the words of Mr. Sigsbee, are "compactness, strength, durability, neatness, facility of handling with a small force, celerity of operations, and economy." The entire amount required to make the deepest dredging can be stored upon a single drum which occupies but an inconspicuous position on the deck. But few men are required for the operations of dredging; and the reeling-in can be performed, in case of necessity, by two men only, one standing at the hoisting-engine, the other at the reel.

[1] One of $1\frac{1}{16}$ inches has also been successfully tried.

Where the dredgings are confined to depths less than a thousand fathoms, as was the case with the steamer Fish Hawk, the hoisting-engine may be dispensed with, and the rope led directly to the reel, which can be made sufficiently strong to withstand the strain put upon it in using so small a quantity of rope. With operations simplified to this extent, a single man can control both the lowering and the reeling-in; the additional help being required only to handle the dredging apparatus on the deck, and to start it on its downward passage.

As to economy of time, the wire rope has a decided advantage over hemp or manila. Sir Wyville Thomson states that

"There can be no doubt that in any future expedition, on whatever scale, it would be an unjustifiable waste of time and space to neglect the use of wire for sounding, and wire rope for dredging and trawling; but it seems to me that even the use of these should be simplified, and not made more complex."

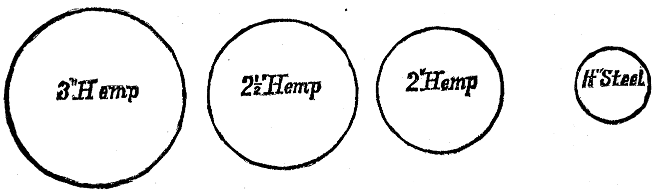

FIG. 1.—COMPARATIVE SIZE OF DREDGE-ROPES.
(From Sigsbee's 'Deep-sea sounding.')

Prof. H. N. Moseley has been even more generous in his acknowledgments; and in a lecture on deep-sea dredging, delivered before the Royal institution of London in 1880, and published in *Nature* for April 8 of the same year, he spoke of the advantages of wire rope, which have already been alluded to.

Accessories to wire rope.

Among the important accessories to the use of wire dredge-rope, which have been introduced in this country, may be mentioned an improved form of accumulator, a set of safety-hooks for attaching the trawls, and several patterns of dredging-blocks.

The Sigsbee accumulator (fig. 3), which replaces the pattern formerly employed by the English, and which has since been adopted on the French steamer Talisman, was first used

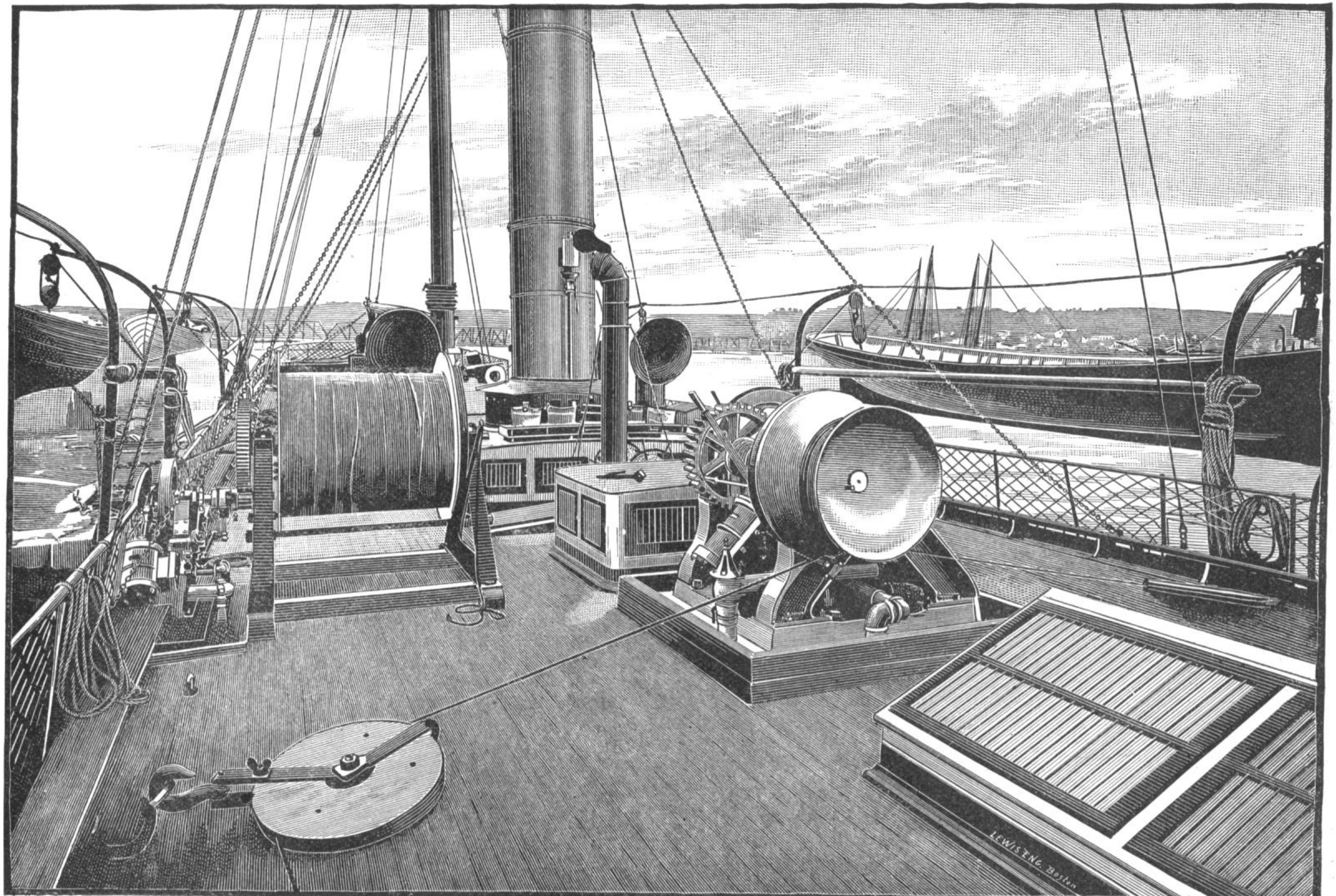

FIG. 2.—VIEW OF THE DECK OF THE BLAKE, READY FOR DREDGING.

(*From Sigsbee's 'Deep-sea sounding.'*)

on the steamer Blake, in 1878. It consists of a number (26 to 37) of rubber car-buffers, arranged for compression on a central rod, and separated from one another by thin brass guide plates provided with hubs or fillets, which prevent the buffers from coming in contact with the rod. Under strain applied at the lower end, the accumulator elongates, and when released from strain is restored to its former length by the elasticity of the buffers. The

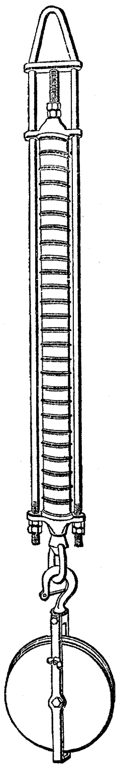

FIG. 3.—SIGSBEE'S ACCUMULATOR FOR DEEP-SEA DREDGING, WITH DREDGE-BLOCK ATTACHED.

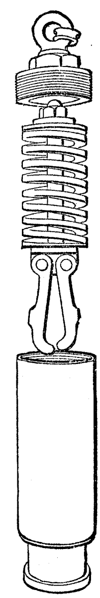

FIG. 4.—THE SAFETY-HOOKS FOR ATTACHING THE BEAM-TRAWL TO THE DRAG-ROPE. SHOWN IN DETAIL.

amount of extension afforded by the Blake's accumulator was six feet, which, according to the experience of Commander Sigsbee, is quite sufficient; the principal purpose of an accumulator being to indicate the amount of strain after fouling, and when the dredge-rope has been hauled tight and is nearly vertical. The English accumulator, consisting of a number of long elastic rods, was intended to relieve the first strain upon the rope in case of fouling.

The safety-hooks (fig. 4) invented by Capt. Tanner, U.S.N., are an ingenious device for releasing the beam-trawl in case of its fouling irretrievably, and thus relieving the strain upon the rope which might otherwise break at some distance above the bottom, thereby entailing an additional loss of rope. They consist of a stout steel spring enclosed in an iron cylinder, and controlling the opening and closing of a pair of heavy iron hooks, which project from one end, and can be adjusted to detach at any point between three thousand and six thousand pounds.

Commander Sigsbee first improved the dredging-blocks. In the deck-blocks, the side plates are free to revolve; but in that which hangs pendent from the boom end, they are pinned to the strap, and connected by socket-bolts, which are intended to prevent the dredge-rope from getting between the side plates and the strap. The dredging-blocks supplied to the Albatross have no side plates; and the sheave, which is of brass, revolves on a series of brass friction-rods surrounding the steel pin or axis.

Sieves.

Convenient sieves for working over the mixed materials after they have been landed upon the deck are very important adjuncts to the dredging work.

The larger proportion of the contents of the dredge and trawl frequently consists of mud or sand, which requires to be washed from the specimens before they can be preserved or studied. Many different devices to accomplish this sifting or washing have been tried, both in this country and in Europe: but of those now employed by the Fish-commission, only one has been borrowed; the others, two in number, having originated with this survey. The three patterns of sieves are intended for different purposes. The simplest is a nest of circular sieves similar to those figured in Sir Wyville Thomson's 'Depths of the sea,' and used for sifting small quantities of material by hand, in a bucket or tub of water.

The rocker or cradle sieve (fig. 5) is designed especially for washing the contents of the dredges; and the table sieves, for the great mass of material which so often comes up in the trawl; but the latter has been found so useful for all kinds of work that it is now most commonly employed, especially as it forms in itself a large and convenient sorting-table around which a number of persons can stand at a time. The cradle sieve was devised by Professor Verrill in 1872, to afford the means of rapid washing over the side of the vessel. It is semicylindrical in shape, the curved bottom and sides consisting of two thicknesses of

wire netting; the lower having a strong and coarse mesh, and designed to give strength to the upper netting which determines the size of material which can be washed through. The end pieces are of wood. A rectangular box fitting into the top of this sieve, and having a coarse wire bottom, is sometimes employed for the purpose described below in the next pattern. The table sieve was the joint invention of Professor Verrill and Capt. Chester in 1877, and was originally intended to receive the contents of the trawl which had been previously dumped upon the deck. It consists of a large rectangular wooden frame, supported upon legs of a convenient height, and with a bottom of heavy galvanized wire-netting which serves to support the real bottom of the sieve. This is of fine wire-netting fitted to a removable frame. Above this is a second, hopper-shaped frame-work, covered underneath with

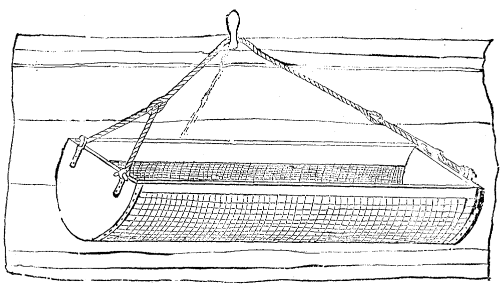

FIG. 5.—VERRILL'S CRADLE SIEVE.

coarse netting, and provided at about the middle of the side with cleats which rest upon the upper edges of the main frame when the three frames are nested together for use. The trawls are emptied into the hopper frame, which retains the coarser objects, allowing the smaller and generally more delicate specimens to be washed out on to the finer netting below. This arrangement of sieves has been found to give greater satisfaction than any other for washing large quantities of material, and keeps the specimens in better condition. The under part of the main frame is covered with heavy canvas, which serves to direct the water to the canvas tube in the centre, and thence over the side of the vessel.

Mr. James E. Benedict, naturalist on the steamer Albatross, has recently added an interesting feature to this sieve, for collecting and cleaning the foraminifera taken in the trawls, and of which many quarts were frequently washed away and lost by the old method at every haul. The canvas tube is simply arranged to lead into the side of a cask placed close to the sieve, and from which the water escapes at a slightly higher level on the opposite side. The heavier particles carried through the tube by the great force of the current are thereby given a chance to settle in the cask; the lighter sediment, composed mostly of fine mud, passing off through the outlet. After the washing has been accomplished, the water remaining in the barrel is decanted or drawn off through a siphon. The washing, in both the cradle and table sieves, is accomplished by means of a stream of water supplied through a hose. The large sieve figured on the deck of the French steamer Talisman in a recent number of *La nature* (see *Science*, vol. iii. p. 453) appears to partake of the character of the table sieve above described, although its details are not shown.

RICHARD RATHBUN.

KAFIRISTAN.

THE adventurous journey of Macnair, disguised as a native physician, into Kafiristan has given us the first testimony of a European eye-witness to the characteristics of that country and its inhabitants. Without recounting the itinerary, or specially detailing the perils of the traveller, which were not few, it may be mentioned that a part of his route lying between Mirga and Lowerai Kotal was at an altitude of 10,450 feet above the sea-level, winding through the snow between heaps of stones, which cover the remains of Mohammedans assassinated by the Kafirs. Elphinstone relates, in his 'History of Kabul,' that, on the occasion of a sacrifice, the prayer offered was, "Defend us from fever, increase our wealth, kill the Mussulmans, and after our death admit us to Paradise." It appears that none of their religious duties are better attended to by the Kafirs than that of killing the Mussulmans. Much the same importance is attached to it as belonged to head-hunting among the Dyaks, and no young Kafir is allowed to marry until he has killed at least one. A very similar feeling would seem to exist towards Europeans.

Kafiristan embraces an area of some five thousand square miles, limited to the north by the stupendous crest of the Hindu Kush, of which at least one peak rises above twenty-five thousand feet; on the south by the Kunar range; and on the east and west chiefly by the Alishang and Kunar rivers. Three distinct tribes — the Ramgals, Vaigals, and Bashgals — correspond to and occupy the three principal valleys of the country, the last being subdivided into five clans. The Vaigals are reputed to be the most numerous, and occupy the largest valley. Each tribe has a distinct dialect, but all have many words in common. In general, the three tribes have few relations with each other. Altogether, they are supposed to number about two hundred thousand people.